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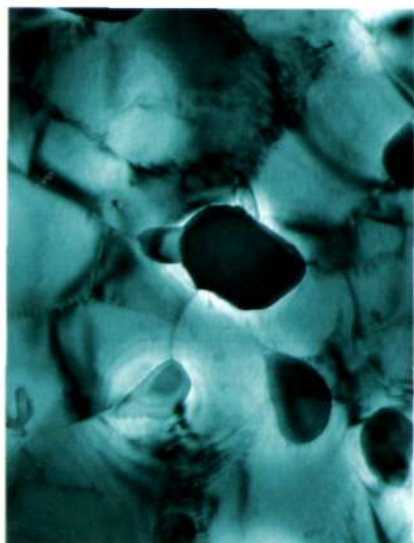
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Cover Photo:

The cover shows a bright field image for the traditional AISI M41 steel under two-beam conditions. More details can be found in the article by H. Halfa on page 495.

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Boschstraße 12, D-69469 Weinheim,
Germany

Contents

Full Paper

D. Lindström, P. Nortier, B. Glaser, and
D. Sichen*

Study on the Possibility of Using ZnO for Hot Metal Desulfurization



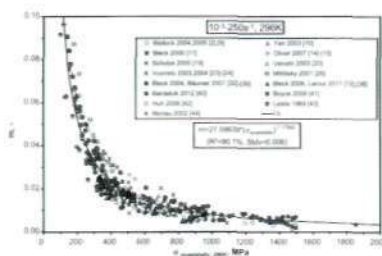
The possibility of using ZnO for desulfurization in hot metal has been evaluated. A experimental setup has been designed so that different desulfurizing agents could be added to hot metal for evaluation of their desulfurizing power. Additions of ZnO into the hot metal under various experimental conditions shows no effect on desulfurization. The results are in contradiction to the suggestion found in literature. A thorough examination of the thermodynamic data employed by the previous work has been carried out.

Contents

P. Larour*, A. Bäumer, K. Dahmen, and W. Bleck

Influence of Strain Rate, Temperature, Plastic Strain, and Microstructure on the Strain Rate Sensitivity of Automotive Sheet Steels

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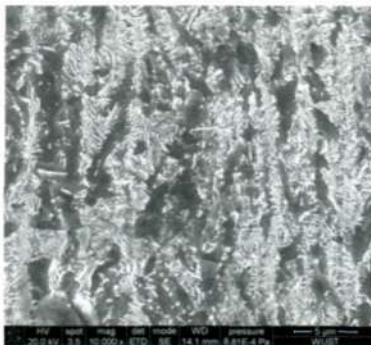
The strain rate sensitivity m of automotive sheet steel grades has been determined by means of servohydraulic dynamic tensile tests in the strain rate range 10^{-3} – 200 s^{-1} and in the temperature range 233–373 K. m -values are improved with decreasing temperature or increasing strain rate and decrease with increasing quasistatic flow stress or plastic strain.

W. P. Yu, R. S. Qin, and K. M. Wu*

The Effect of Hot- and Cold-Rolling on the Electropulse-Induced Microstructure and Property Changes in Medium Carbon Low Alloy Steels

EDITOR'S CHOICE

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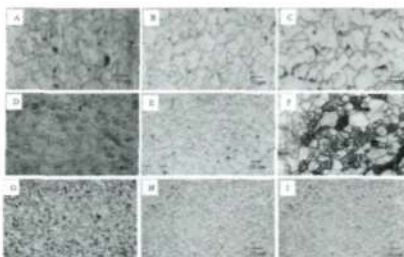


A SEM micrograph of cold-rolled specimens treated with 6.0 kV voltage electropulsing treatment. The electropulsing treatment causes microstructure refinement and improvements in mechanical properties in cold-rolled steels. The effect of electropulsing is found to be negligible in hot-rolled steels. The combined effects of high dislocation density and electropulsing causes microstructure transformations.

S. N. Ghali

Low Carbon High Nitrogen Low Nickel Stainless Steel

450



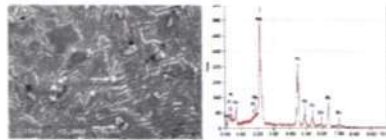
In this study, the solubility behaviors of nitrogen in two free nickel- and low nickel-austenitic stainless steels have been investigated. Furthermore, the microstructure and mechanical properties of the investigated stainless steels are compared with a reference conventional nickel-austenitic stainless steel. The strengthening mechanisms contribution to strength of both soluble and insoluble nitrogen has been analyzed.

Contents

K. Yang* and Y. F. Bao

Improving High-Temperature Wear Resistance of Fe-Cr13-C Hardfacing Alloy by Nitrogen Alloying

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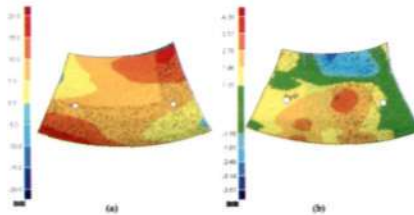


A large number of carbonitrides precipitated with very fine sizes and distributed homogeneously in the matrix during the high-temperature wear, which cannot only enhance the wear resistance but also decrease the susceptibility to crack. So the hardfacing alloy with nitrogen has microstructures in which hard, fine carbonitrides are homogeneously distributed in the matrix, and thus has excellent high-temperature hardness, crack resistance, and wear resistance.

J. Liao, X. Xue, C. Zhou*, F. Barlat, and J. J. Gracio

A Springback Compensation Strategy and Applications to Bending Cases

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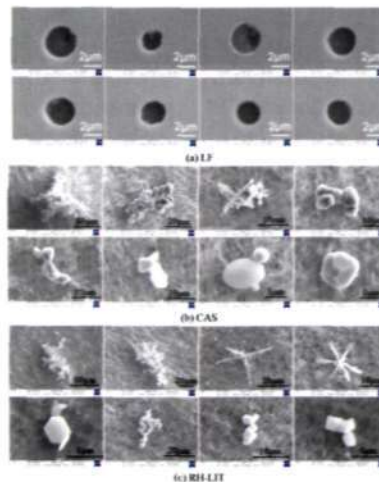


Part shape error due to springback is a manufacturing defect in the sheet metal forming. This problem can be corrected by adjusting the tool shape to an appropriate shape or process optimization. A discrete curvature adjustment (DCA) strategy is developed for tool design of complex bending products. It aims at generating the right tool shape in a short time using the measured data from stamped part.

W. Yang, X. Wang, L. Zhang*, Q. Shan, and X. Liu

Cleanliness of Low Carbon Aluminum-Killed Steels during Secondary Refining Processes

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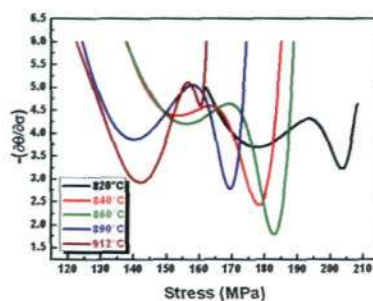


After LF refining, inclusions are transformed to small spheres. However, even at the end of CAS and RH-LIT refining, there are still many large clusters and aggregates observed, they are very detrimental to the subsequent casting process. Besides, many small spherical and polyhedral particles are observed as well in the steel samples after CAS and RH refining.

Contents

C. Ghosh*, V. V. Basabe, and J. J. Jonas
Determination of the Critical Strains for the Initiation of Dynamic Transformation and Dynamic Recrystallization in Four Steels of Increasing Carbon Contents

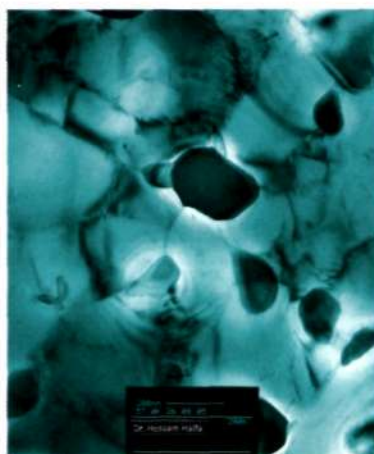
490



The formation of ferrite during rolling at temperatures above the Ae_3 is a controversial topic. Here it is shown that strong evidence for the occurrence of this transformation can be obtained directly from the flow curve of the deformation using the double-differentiation method. The critical strain for dynamic transformation is shown to be distinctly less than that for dynamic recrystallization.

H. Halfa
Characterization of Electroslag Remelted Super Hard High Speed Tool Steel Containing Niobium

495



In this work, thermodynamical equilibria have been calculated for super hard high speed steel, AISI M41 composition belonging to the multicomponent system Fe–C–Cr–W–Mo–V–Co as well as for its three different variants containing niobium. Effect of niobium and high cooling rate during electroslag remelting on the precipitated carbides, morphology of carbides, secondary hardening temperature, and wear rate of investigated steels are studied.

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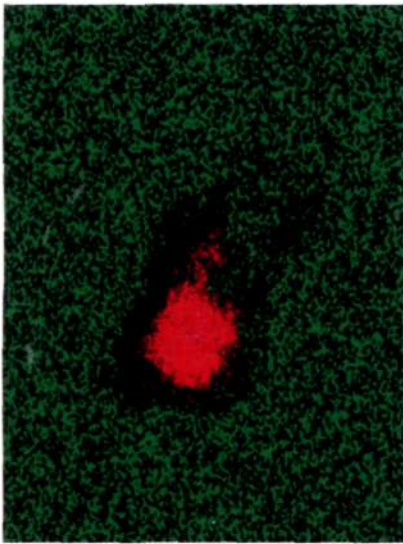
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Cover Photo:

This front cover image reveals the surface vanadium element distribution map of the vanadium rich inclusion particle, which exists in the inner arc of continuous casting by means of SEM surface scanning. More details can be found in the article by M. M. Wu and co-workers on page 534.

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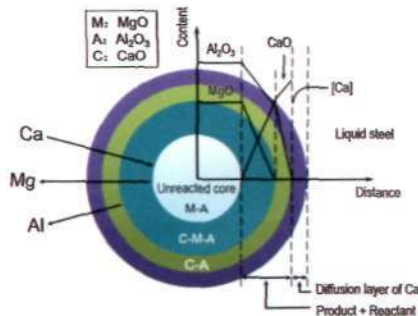
Contents

Full Paper

Z. Deng and M. Zhu

A New Double Calcium Treatment Method for Clean Steel Refining

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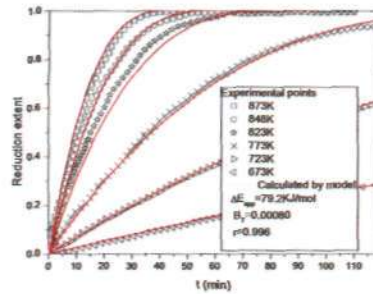


A new double calcium treatment method is proposed according to industrial experiment. In the new process, the evolution of inclusion is analyzed and the controlling standard of $T.[Ca]/T.[O]$ ratio for calcium treatment is discussed. In order to get a good calcium treatment result, $T.[Ca]/T.[O]$ ratio should be controlled above 0.91, and the ratio between 0.91 and 1.25 is suitable in present work.

Contents

J. Dang, K.-C. Chou*, X.-J. Hu, and G.-H. Zhang
Reduction Kinetics of Metal Oxides by Hydrogen

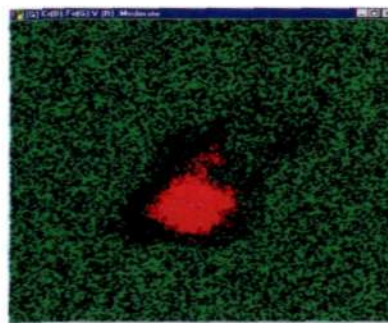
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A new kinetic model has been developed for reduction of metal oxides with hydrogen under both isothermal and non-isothermal conditions. This model can describe the kinetics of single reductive reaction and double reductive reactions by considering the diffusion and chemical reaction controlling mechanisms. The model predicted curves agree well with the experimental results from the literatures.

M. M. Wu*, H. Yu, Y. F. Fan, E. X. Wang, and J. J. Wang
Research of the Continuous Casting Slab Transverse Cracking During Retarded Cooling Process

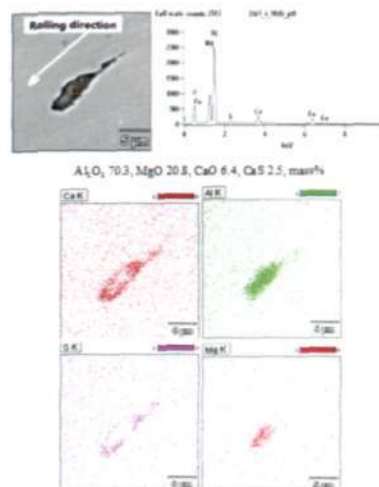
534



The reason of 50Mn2V transverse cracking is studied by a series of means, optical metallographic, SEM for microstructure, fracture surface and inclusions and insitu analysis for element segregation. In summary, internal gas pressure should be the dominant factor that leads the transverse embrittlement of continuous casting blank, while inadequate microstructure, internal stresses, element segregation, and defects play an ancillary role.

J. Guo, S. Cheng, Z. Cheng, and L. Xin
Thermodynamics for Precipitation of CaS Bearing Inclusion and Their Deformation During Rolling Process for Al-Killed Ca-Treated Steel

545



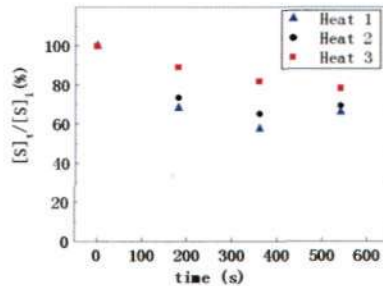
The first type of duplex CaS bearing inclusion forms due to CaS precipitating directly surrounding solid inclusion core; the second type is as modified calcium aluminates react with dissolved sulfur and aluminum. During rolling, the outer CaS rich layer of the first type inclusion is easily separated from the inner core while the later one performs a better deformation.

Contents

F. Jiang, G. Cheng, G. Qian, Y. Xie, Q. Rui, and L. Yang

Evaluation of Sulfur Addition to the High Basicity Slag on the Sulfur, Aluminum, and Cleanliness of High Sulfur Al-Killed Molten Steel

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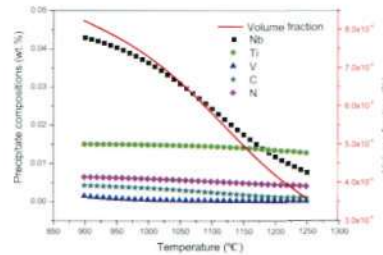


The addition of CaS into slag can reduce [S] loss in the molten steel. At time $t = 360$ s, the sulfur content in the molten steel decreases to $< 60\%$ of the initial sulfur content, when no CaS is added into the slag (Heat 1), but the sulfur content in the molten steel decreases only to 80% of the initial sulfur content, when 5% CaS is added into the slag (Heat 3). The reason may be that after addition of CaS, the content of reaction product CaS in the slag has been increased, which suppressed the desulfurization reaction.

Y. Xu, D. Tang, and Y. Song

Equilibrium Modeling of (Nb, Ti, V) (C, N) Precipitation in Austenite of Microalloyed Steels

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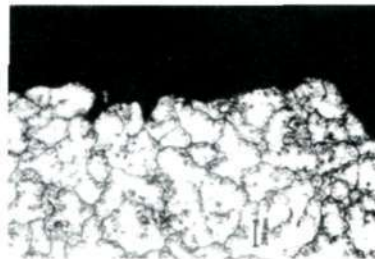
A simple theoretical model which is based on the solubility products of the individual nitrides and carbides was proposed to predict the equilibrium composition of multicomponent precipitates in Nb–V–Ti bearing steel. And the volume fraction of the second phase particles in equilibrium at given temperature can also be obtained by the developed model.

M. O. El-Bealy

Advanced Solute Conservation Equations for Dendritic Solidification Processes Part I: Experiments and Theory

EDITOR'S CHOICE

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Macrosegregation in dendritic equiaxed structure during the early stages of solidification of Al-4.5%Cu alloy has been studied experimentally. The metallurgical study includes macro-microstructure evaluation, measurements of grain size of equiaxed crystals, and macrosegregation analysis. In addition to the experimental work, there is a mathematical study which contains a complete derivation of local solute redistribution equations based on Fleming's approach under different solute diffusion mechanisms in the dendritic solid.

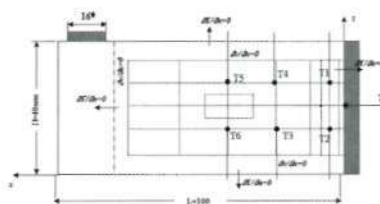
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M. O. El-Bealy

Advanced Solute Conservation Equations for Dendritic Solidification Processes Part II: Numerical Simulations and Comparisons

EDITOR'S CHOICE

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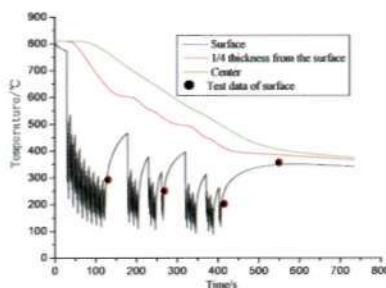


The mathematical model of derived solute equations in Part I for equiaxed dendritic solidification with melt convection streams and thermal is applied numerically to predict macrosegregation distributions in dendritic solid. Numerical and experimental results are present for solidification of a Al-4.5% Cu alloy inside horizontal rectangular cavity at different superheats.

D.-M. Zhu, G.-Y. Liu, S.-J. Zhang, and M.-W. Li

Study of New On-Line Pre-Hardening Technology of 3Cr2NiMo Plastic Die Steel

607



New online pre-hardening equipment for quenching die steel has been developed. Based on the equipment, different online quenching processes of 3Cr2NiMo die steel plate with the thickness of 130 mm were performed by numerical simulation and production experiments. Under the optimal process, the tempering hardness difference was less than 3HRC in the whole 3Cr2NiMo steel plate, and there were no cracks in the steel plate.